Geraniums and Begonias

New Research on Old Garden Favorites

Some insect pests are very specialized—usually feasting on one crop. Many are named after that one particular crop that they ingest most—like pickleworms, melonworms, and sweetpotato weevils. Unfortunately for growers of ornamentals, soybean, maize, fruit, and vegetables, the Japanese beetle is not a picky eater. It feeds on nearly 300 plant species in almost 80 plant families.

The beetle, *Popillia japonica,* is by far the most destructive pest of ornamental and turf plants in the eastern United States, with more than $450 million spent each year to control it and replace damaged plants.

But there is hope, since there is one plant that the hungry little critter may want to avoid—the geranium, *Pelargonium zonale*. Though its lovely, colorful flowers are very attractive for all and profitable for growers, the flowers are deadly to the beetles. Within 30 minutes of consuming the petals, the beetle rolls over on its back, its legs and antennae slowly twitch, and it remains paralyzed for several hours. When paralyzed under laboratory conditions, the beetles typically recover within 24 hours, but they often die under field conditions because predators spot and devour them.

The poisoning effect of geranium flowers on beetles is not a new discovery; it has been reported in scientific papers dating back to the 1920s. But the phenomenon has not been studied in depth—how or why it happens—until recently, when Agricultural Research Service scientists in Ohio picked up where scientists left off more than half a century ago.

Currently, Chris Ranger, an entomologist in the ARS Application Technology Research Unit in Wooster, is working on a natural, botanical formulation for controlling the beetles based on paralytic compounds isolated from geraniums. Patent rights are being pursued. Ranger is collaborating with Ajay Singh, a natural products chemist from Rutgers, The State University of New Jersey.

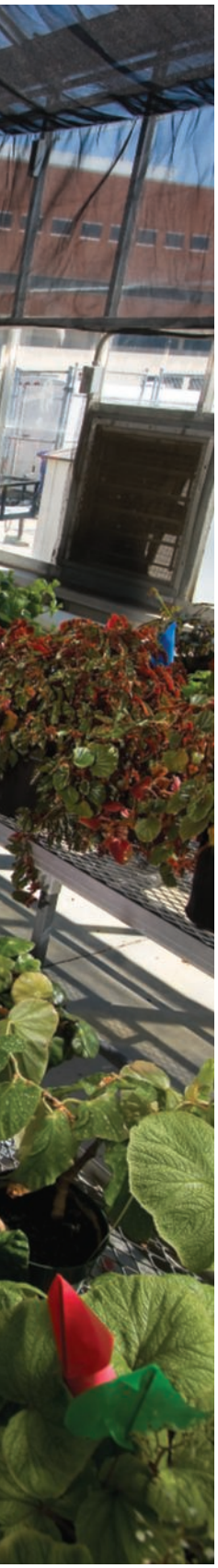
Also at Wooster, agricultural engineer Heping Zhu is working on pesticidal droplet reactions on hairy and glassy (waxy)

STEPHEN AUSMUS (D1585-4)

Technicians Gerald Hammel (left) and Alane Robinson prepare geranium leaves for grinding, extracting, and filtering, while entomologist Christopher Ranger (background) separates and purifies the active phytochemicals.

STEPHEN AUSMUS (D1681-3)

ARS horticulturist Jonathan Frantz (left) and Ohio State horticulturist Susan Stieve evaluate begonia plants for tolerance to cold and flowering characteristics in a greenhouse at the Ornamental Plant Germplasm Center at Ohio State University.



geranium species that could help leaves retain and hold on to the pesticides that are sprayed on them—which, in turn, could help reduce pesticide use.

Meanwhile, at ARS in Toledo, horticulturist Jonathan Frantz is collaborating with Susan Stieve, curator of Ohio State University's Ornamental Plant Germplasm Center in Columbus, in studies of begonias.

Begonias are considered to be sensitive to high light and perform best under low-light conditions found in shade gardens or along the north side of houses. If varieties are found that grow equally well in high light, they could be used in breeding programs or grown commercially. This fits commercial growers' systems well because they have gone to great effort to maximize the light inside greenhouses.

The team found that two varieties—*Begonia cubensis* and *B. echinosepala* var. *elongatifolia*—performed well in either light environment.

"Their leaf area, plant weight, and flower development did not appear to be negatively affected by the higher light levels," says Frantz. "Lower light environments still result in less bleaching in other begonia species, but all species we tested had similar sizes and developmental rates in either light level."

Frantz and Stieve are also studying whether a specialized breed of begonia can tolerate colder temperatures.

Ohio and neighboring Michigan are some of the largest producers of horticultural plants, most of them grown in greenhouses. The scientists are screening the begonias at two production temperatures—5°F colder than normal and 10°F colder than normal. Begonias are found naturally in a wide variety of climates and altitudes—ecological clues that can be used to identify promising germplasm.

"For every one degree cooler, growers can reduce heating bills by 3 percent in northern climates," said Frantz. "And with the way energy costs are rising, that can make a huge difference in operating expenses. But the tradeoff is that cooler temperatures can greatly delay flower development." The trick is to find varieties or species with acceptable growth and with flowers that are not delayed significantly by cooler temperatures.—By **Alfredo Flores,** ARS.

This research is part of Crop Protection and Quarantine, an ARS national program (#304) described at www.nps.ars.usda.gov.

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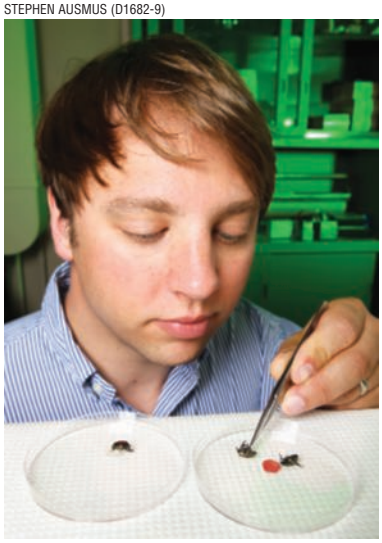
STEPHEN AUSMUS (D1586-5)

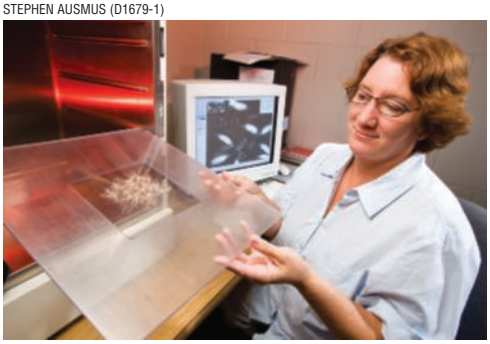
Using high-performance liquid chromatography, entomologists Michael Reding (left) and Christopher Ranger analyze geranium extracts with paralytic activity against Japanese beetles to identify the active phytochemicals.

STEPHEN AUSMUS (D1682-9)



Christopher Ranger observes healthy (left petri dish) and paralyzed (right petri dish) Japanese beetles after the beetles on the right consumed extracts isolated from geranium flowers.

STEPHEN AUSMUS (D1679-1)



Susan Stieve uses X-ray technology to assess seed quality of geranium (*Pelargonium* sp.).